Faculty Project Information

Embodied Music: Visualizing Music through Robotic Motion and Light for Inclusive Music Experience

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Research Field:	Human-robot Interaction

Brief Description

Music is a powerful medium for emotional expression and social connection, yet Deaf and Hard-of-Hearing (DHH) individuals often face barriers to experiencing it due to its reliance on auditory perception. Recent AI-driven systems have attempted to bridge this gap by combining music information retrieval (MIR) with generative visual synthesis for audio-reactive displays.

While these approaches provide visual channels for experiencing music, they still struggle to convey the expressive and dynamic qualities of music in a more embodied and socially engaging way.We propose a low-latency robotic-arm-driven music visualization system that transforms audio features into UV-light trajectories projected onto a phosphorescent surface.

Unlike conventional virtual visualizations, the robotic arm introduces a tangible, embodied dimension to music by transforming auditory signals into kinetic motion patterns that can be visually perceived and physically felt. At the same time, the integration of light visualization adds an additional layer of multimodal feedback, mapping musical features such as rhythm, loudness, and timbre into dynamic visual cues.This approach builds on the idea that music is not only heard, but also seen and felt.

By extending musical interaction through robotic motion and light embodiment, our system aims to create more inclusive and immersive experiences that enable DHH individuals not only to personally connect with music, but also to share in social practices such as dancing with others—whether in pairs, at concerts, in parks, or even across generations. In doing so, the system fosters a stronger sense of belonging, enabling DHH individuals to engage in musical and social worlds from which they have historically been excluded.

Expected Outcome(s)

- A research demo
- A paper submission to an HRI conference

Key Student Tasks

- Conduct user needs analysis with industry partners and Business Chinese learners
- Design scenario-based learning pathways for meetings, negotiation, requests, and refusals
- Develop the mini-program / app architecture and core features
- Implement backend systems, data tracking, and basic analytics
- Create bilingual instructional content and intercultural communication guidance
- Carry out user testing and iterative product refinement
- Produce project deliverables (demo product, documentation, pitch materials)
- Participate in final pitch and campus showcase

Requirements for Student Applicants

- Python and C++ programming
- UX design